EPA science: casualty of election politics

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The struggle between the Congress and the White House over environmental issues provides an opportunity for improving science at the US Environmental Protection Agency, a chance that may be lost in the fray of election-year politics.

JUST over a quarter of a century ago, when I began working at the US Environmental Protection Agency (EPA)'s research laboratory in Athens, Georgia, our scientists devoted most of their time to hands-on research aimed at solving the country's environmental problems. The agency's technical workforce consisted mainly of federal scientists, including researchers and technicians, along with stay-in-school students from nearby universities. The EPA now has about a third fewer scientists, and their time is largely consumed by administrative red tape, overseeing contracts and other funding agreements designed to accommodate increasing workloads and a diminishing federal staff.

Citing Superfund and other programmes that have used an increasingly small fraction of their resources to address environmental problems, Newt Gingrich (Republican, Georgia), Speaker of the House of Representatives, has called for a new era of environmentalism, one that is 'scientifically sound, economically rational and politically popular'[1]. So far, however, all congressional efforts to achieve this new era have been widely perceived as wholly anti-environmental.

Organizational gridlock

Various independent studies have assessed the status of the EPA's Office of Research and Development (ORD), which is responsible for providing the scientific basis for regulatory activities[2,3]. Collectively, these present a unified picture of an organization plagued with problems typical of large government bureaucracies. The studies recommend putting into place various measures, which have been reinforced by the National Performance Review (NPR)[4], including downsizing and decentralizing the top-heavy Washington management structure, reducing the overall ratio of supervisors to workers, giving more power to lower management levels and eliminating redundant programmes and excessive red tape.

Whereas the problems encumbering the agency's scientists have accrued over almost three decades, a major shift in resources from in-house to extramural research during the past ten years is largely responsible for science at the EPA reaching a state of crisis. ORD policy directives and budget figures track the course of this transition (Fig. 1), which arose because Congress increased the EPA's funding levels and workloads while the executive branch reduced the size of the federal workforce. Over a two-year period beginning in 1992, ORD issued about 200 directives on how to manage extramural resources using funding mechanisms that do not lend themselves well to the conduct of research. Many of these later became permanently embodied in ORD's manual on policies and procedures.

By late 1993, the organization charged with ensuring that US environmental regulations are scientifically sound became hopelessly gridlocked[5]. With scientists largely untrained to manage extramural funding mechanisms and deal with a quagmire of government rules, regulations and policies, they and their front-line managers became targets of investigations by the EPA's inspector general. Allegations of mismanagement abounded as the director of the EPA's research laboratory in Duluth, Minnesota (the first of several laboratories to be investigated), was fired and other managers and scientists were either dismissed or sent on leave without pay. They were, however, reinstated by federal judges, who ruled that the agency's allegations were without merit and that investigations had been carried out in bad faith[6-8].

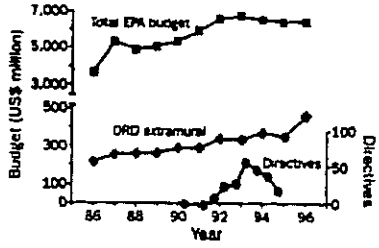

FIG. 1 The EPA's Office of Research and Development (ORD) budgets for contracts, cooperative agreements and other extramural support mechanisms, numbers of directives issued by ORD for guidance in managing extramural support, and total EPA budgets. (Source: US EPA.)

Vehicle without an engine

Because environmental regulations are aimed at minimizing the negative impact of humans on other living organisms, regulatory activities are driven by concerns of a biological nature. Nevertheless, understanding and applying knowledge of biological phenomena remain by far the weakest links in environmental protection. Relative to our understanding of biological processes, we know much more about how fast pollutants react chemically in the environment, to what degree they are bound by sorption and to what extent they are transported by diffusion, volatilization and other physical processes. Understanding how most living organisms interact with chemical and physical changes in their environment, especially at complex ecological levels, is a particularly daunting challenge. Yet, without this understanding, our knowledge of chemical and physical aspects of environmental science yields only the framework of a vehicle in which we can put the engine one day, once it is built.

Historically, the number of EPA professionals educated in the life sciences has been low compared with those trained in the physical sciences, and has been decreasing in recent years (Fig. 2). Reflecting this disparity, only a third of the internal grants awarded so far by ORD support projects in the biological sciences.

Most organic chemicals undergo structural changes mediated by organisms living in soil and water, often very rapidly. Without understanding these processes, how can the EPA reliably determine whether chemicals should be permitted for manufacture under its Pre-Manufacturing Notification process, if wastes should be deemed hazardous under its Hazardous Waste Disposal Rule or how they should be remediated under its Remediation Feasibility Implementation Study? To look at this from another perspective, consider what it would be like for the Centers for Disease Control and Prevention to use this approach. Begin by erasing most of their knowledge about the biological aetiology of human disease, then give them independent regulatory authority. Let them take their best guesses at, for example, what steps should be taken to prevent outbreaks of influenza and other infectious diseases. Finally, codify their guesswork and conservative safety factors into costly regulations for which noncompliance carries fines and imprisonment. Few people would support such an irrational approach to protecting public health; yet this is basically what happens when environmental regulations are promulgated and enforced without knowledge of how most living organisms interact with environmental changes.

Broad vision, bold steps

The EPA recently realigned its twelve research laboratories, three field stations and four assessment centres along functional lines under a risk-based paradigm, resulting in the establishment of three national laboratories and two centres[2]. The agency also committed itself to developing a strategic plan for science, created an investigator-initiated internal grants programme, increased support for its extramural grants programme fivefold (from $20 to $100 million) and established a peer-review process for all scientific and technical products.

Some of these changes, such as formally defining its mission and instituting a more comprehensive peer-review process, will undoubtedly strengthen the agency's science. On the other hand, some changes have a clear potential for diminishing productivity and undermining the quality of the science. By centralizing research into mega-laboratories, the EPA's scientific organization will tend to follow the big-bureaucracy path previously forged by the agency's Washington headquarters and regional offices. In time, this could greatly reduce the fraction of resources spent actually doing research as opposed to managing it. ORD has already assessed that its national laboratories need an additional 22 administrative positions each to get them started. To house them, the EPA has begun by targeting around $250 million in construction costs for a new building complex in Research Triangle Park, North Carolina.

Administrative duties, which previously allowed scientists to spend only half their time doing research[3], have become more onerous, with managers and scientists responding to requests from national laboratory headquarters as well as from Washington. Ecologists are concerned that at a time when they should be putting more scientists and resources into research laboratories dispersed in the field, centralization of the organization into national laboratories will damage their basic ecological research efforts. And although it is true that ORD should devote a greater portion of its resources to funding extramural research, recent increases in this category are part of a plan exclusively to use grants instead of cooperative agreements, the only extramural funding mechanism that allows agency scientists to work hand-in-hand with researchers at universities and other research institutions. Already severely restricted from interacting with their outside counterparts because of agency-imposed travel limitations, EPA scientists and engineers are now more professionally isolated than ever before.

If EPA is to retain its role as the federal agency responsible for environmental protection, it must develop a broad vision of the science needed and take bold steps to acquire and apply it. This will require more than just improving ORD. It means making fundamental changes in the structure and mission of the agency as a whole so that science leads rather than trying to catch up with the promulgation of environmental regulations. Clearly, we already have an adequate understanding of the effects of many of our activities that directly affect the environment. So minimum-level national environmental standards for basic environmental protection can already be set in many areas with reasonable confidence. Issues where the effects of our activities on living organisms are largely in question from a scientific standpoint are a different matter. These need recommendations, not regulations.

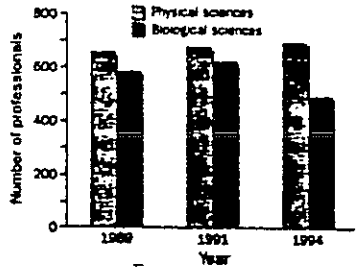

FIG. 2 Number of professionals in the EPA's Office of Research and Development (ORD) trained in mathematics, engineering, chemistry or physics compared with biological sciences. (Source: ORD, *Workforce 89, 91, 94.*)

In many cases, protecting public health through recommendations made by a non-regulatory agency (the Centers for Disease Control and Prevention) has worked well and provides a reasonable model for environmental protection. To say the least, it is odd that the federal government protects public health through voluntary recommendations where the underlying science is strong, and the environment through mandatory regulations where the scientific basis is weak. This does not mean that we should wait until the most minuscule uncertainties are resolved in environmental issues, only that the science should be both compelling and widely accepted before federal regulations are promulgated.

The philosophy of federally mandated environmental protection has been to err on the safe side by making it difficult and expensive to do anything that changes our natural environment. This approach is based on the assumption that every change wrought by mankind ultimately has a net negative impact on the long-term health of the environment. Until we have a better understanding of how living organisms interact with the environmental changes brought about by our activities, especially the more subtle ones, we cannot know whether precluding any of these changes will ultimately be detrimental or beneficial.

To provide the overall organizational structure for establishing scientifically sound environmental policies, a cabinet-level Department of Environment should be created, pulling together the EPA with parts of other agencies and departments involved in the environmental sciences, such as the Departments of Energy, Agriculture and Interior, and the National Aeronautics and Space Administration. In particular, many of the Department of Agriculture's field stations due to be closed in areas where farming is no longer important could be transformed into environmental research laboratories under the direction of the EPA's regionally dispersed ecological research divisions. These could interact with communities on local environmental issues across the country now that environmental concerns are as ubiquitous as agriculture once was, and serve as sentinels of developing environmental trends. Finally, a leading environmental scientist should be appointed as head of the EPA to oversee major changes aimed at achieving a solid scientific basis for federal environmental rules and regulations.

Congress has placed on the national agenda the need to rectify the EPA's inadequate basis for supporting its regulatory process with sound science. It is an unprecedented opportunity to improve an agency that, like all federal bureaucracies, resists change. Environmentalists, on the other hand, have effectively portrayed efforts to alter environmental regulations and the agency that enforces them as a prescription for environmental destruction. But any benefits to the environment today will quickly vaporize if the end result of these battles is that we lose the opportunity to make bold changes, which are needed for building a scientifically sound foundation for environmental protection.

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This commentary represents the author's personal views, and not those of the US EPA.

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